CLAIMS

1. An optical signal receiver that receives and frequency-demodulates an optical signal, comprising:

an optical branch circuit for splitting an input optical signal into two signals;

an optical delay line for delaying one of the two branched optical signals;

a first photoelectric conversion circuit for converting the optical signal from the optical delay line into a first electrical signal;

a second photoelectric conversion circuit for converting the other optical signal of the two branched optical signals into a second electrical signal;

rectangular-wave forming means that outputs a single rectangular-waveform signal using the first electrical signal from the first photoelectric conversion circuit and the second electrical signal from the second photoelectric conversion circuit as inputs; and

a smoothing circuit for smoothing the rectangular-wave signal from the rectangular-wave forming means.

2. The optical signal receiver according to claim 1, wherein

the rectangular-wave forming means has:

a first discrimination circuit that discriminates the

level of the first electrical signal from the first photoelectric conversion circuit by comparing its magnitude with a threshold and outputs a first binary signal;

a second discrimination circuit that discriminates the level of the second electrical signal from the second photoelectric conversion circuit by comparing its magnitude with a threshold and outputs a second binary signal; and

an AND circuit that performs an AND operation on the first binary signal from the first discrimination circuit and the second binary signal from the second discrimination circuit and outputs the single rectangular-wave signal.

3. The optical signal receiver according to claim 1, wherein

the rectangular-wave forming means has:

a first discrimination circuit that discriminates the level of the first electrical signal from the first photoelectric conversion circuit by comparing its magnitude with a threshold and outputs a first binary signal;

a second discrimination circuit that discriminates the level of the second electrical signal from the second photoelectric conversion circuit by comparing its magnitude with a threshold and outputs a second binary signal;

an OR circuit that performs an OR operation on the first binary signal from the first discrimination circuit and the second binary signal from the second discrimination circuit and outputs the single rectangular-wave signal.

4. The optical signal receiver according to claim 1, wherein

the rectangular-wave forming means has:

a first limiter amplifier that limits and amplifies the first electrical signal from the first photoelectric conversion circuit and outputs a first binary signal;

a second limiter amplifier that limits and amplifies the second electrical signal from the second photoelectric conversion circuit and outputs a second binary signal;

an adder circuit that adds the first binary signal from the first limiter amplifier and the second binary signal of the second limiter amplifier and outputs a ternary signal; and

a high level discriminator that discriminates the level of the ternary signal from the adder circuit by comparing its magnitude with a threshold existing between a level when the optical signal is inputted into both the first photoelectric conversion circuit and the second photoelectric conversion circuit and a level when the optical signal is inputted into either the first photoelectric conversion circuit or the second photoelectric conversion circuit and outputs the single

rectangular-wave signal.

5. The optical signal receiver according to claim 1, wherein

the rectangular-wave forming means has:

a first limiter amplifier that limits and amplifies the first electrical signal from the first photoelectric conversion circuit and outputs a first binary signal;

a second limiter amplifier that limits and amplifies the second electrical signal from the second photoelectric conversion circuit and outputs a second binary signal;

an adder circuit that adds the first binary signal from the first limiter amplifier and the second binary signal of the second limiter amplifier and outputs a ternary signal; and

a low level discriminator that discriminates the level of the ternary signal from the adder circuit by comparing its magnitude with a threshold existing between a level when the optical signal inputted into both the first photoelectric conversion circuit and the second photoelectric conversion circuit and a level when the optical signal is inputted into neither the first photoelectric conversion circuit nor the second photoelectric conversion circuit and outputs the single rectangular signal.

6. Optical signal receiving equipment that receives and frequency-demodulates an optical signal, comprising:

(1) an optical branch device that splits an input optical signal into N signals (N is an integer of two or more); and

(2) N optical signal receivers each of which has:

an optical branch circuit that splits the optical signal from the optical branch device into two signals;

an optical delay line for delaying one of the two branched optical signals;

a first photoelectric conversion circuit for converting the optical signal from the optical delay line into a first electrical signal;

a second photoelectric conversion circuit for converting the other optical signal of the two branched optical signals into a second electrical signal;

rectangular-wave forming means for forming a single rectangular-wave signal using the first electrical signal from the first photoelectric conversion circuit and the second electrical signal from the second photoelectric conversion circuit as inputs; and

a smoothing circuit for smoothing the rectangular-wave signal from the rectangular-wave forming means; and

(3) an inphase combiner that combines the N smoothed rectangular-wave signals outputted from the N optical signal receivers, respectively, being in phase with one

another.

7. The optical signal receiving equipment according to claim 6, wherein

the rectangular-wave forming means of the optical signal receiver has:

a first discrimination circuit that discriminates the level of the first electrical signal from the first photoelectric conversion circuit by comparing its magnitude with a threshold and outputs a first binary signal;

a second discrimination circuit that discriminates the level of the second electrical signal from the second photoelectric conversion circuit by comparing its magnitude with a threshold and outputs a second binary signal; and

an AND circuit that performs an AND operation on the first binary signal from the first discrimination circuit and the second binary signal from the second discrimination circuit and outputs the single rectangular-wave signal.

8. The optical signal receiving equipment according to claim 6, wherein

the rectangular-wave forming means of the optical signal receiver has:

a first discrimination circuit that discriminates the level of the first electrical signal from the first

photoelectric conversion circuit by comparing its magnitude with a threshold and outputs a first binary signal;

a second discrimination circuit that discriminates the level of the second electrical signal from the second photoelectric conversion circuit by comparing its magnitude with a threshold and outputs a second binary signal; and

an OR circuit that performs an OR operation on the first binary signal from the first discrimination circuit and the second binary signal from the second discrimination circuit and outputs the single rectangular-wave signal.

9. The optical signal receiving equipment according to claim 6, wherein

the rectangular-wave forming means of the optical signal receiver has:

a first limiter amplifier that limits and amplifies ~~the first electrical signal from the first photoelectric~~ conversion circuit and outputs a first binary signal;

a second limiter amplifier that limits and amplifies the second electrical signal from the second photoelectric conversion circuit and outputs a second binary signal;

an adder circuit that adds the first binary signal from the first limiter amplifier and the second binary signal from the second limiter amplifier and outputs a ternary signal; and

a high level discriminator that discriminates the level of the ternary signal from the adder circuit by comparing its magnitude with a threshold existing between a level when the optical signal is inputted into both the first photoelectric conversion circuit and the second photoelectric conversion circuit and a level when the optical signal is inputted into either the first photoelectric conversion circuit or the second photoelectric conversion circuit and outputs the single rectangular signal.

10. The optical signal receiving equipment according to claim 6, wherein

the rectangular-wave forming means of the optical signal receiver has:

a first limiter amplifier that limits and amplifies the first electrical signal from the first photoelectric conversion circuit and outputs a first binary signal;

a second limiter amplifier that limits and amplifies the second electrical signal from the second photoelectric conversion circuit and outputs a second binary signal;

an adder circuit that adds the first binary signal from the first limiter amplifier and the second binary signal from the second limiter amplifier and outputs a ternary signal; and

a low level discriminator that discriminates the level of the ternary signal from the adder circuit by comparing

its magnitude with a threshold existing between a level when the optical signal is inputted into either the first photoelectric conversion circuit or the second photoelectric conversion circuit and a level when the optical signal is inputted into neither the first photoelectric conversion circuit nor the second photoelectric conversion circuit and outputs the single rectangular signal.

11. An optical signal transmission system using an FM batch conversion method, comprising:

(1)an optical signal transmitter equipped with an FM batch conversion circuit; and

(2) an optical signal receiver having:

an optical branch circuit that is connected with the optical signal transmitter through an optical transmission path and splits an optical signal from the optical signal transmitter into two signals;

~~--an optical delay line for delaying one of the two~~ branched optical signals;

a first photoelectric conversion circuit for converting the optical signal from the optical delay line into a first electrical signal;

a second photoelectric conversion circuit for converting the other optical signal of the two branched optical signals into a second electrical signal;

rectangular-wave forming means for outputting a

single rectangular-wave signal using the first electrical signal from the first photoelectric conversion circuit and the second electrical signal from the second photoelectric conversion circuit as inputs and outputs a single rectangular-wave signal; and

a smoothing circuit for smoothing the rectangular-wave signal from the rectangular-wave forming means.

12. The optical signal transmission system according to claim 11, wherein

the rectangular-wave forming means of the optical signal receiver having:

a first discrimination circuit that discriminates the level of the first electrical signal from the first photoelectric conversion circuit by comparing its magnitude with a threshold and outputs a first binary signal;

a second discrimination circuit that discriminates the level of the second electrical signal from the second photoelectric conversion circuit by comparing its magnitude with a threshold and outputs a second binary signal; and

an AND circuit that performs an AND operation on the first binary signal from the first discrimination circuit and the second binary signal from the second discrimination circuit and outputs the single rectangular-wave signal.

13. The optical signal transmission system according to claim 11, wherein

the rectangular-wave forming means of the optical signal receiver has:

a first discrimination circuit that discriminates the level of the first electrical signal from the first photoelectric conversion circuit by comparing its magnitude with a threshold and outputs a first binary signal;

a second discrimination circuit that discriminates the level of the second electrical signal from the second photoelectric conversion circuit by comparing its magnitude with a threshold and outputs a second binary signal; and

an OR circuit that performs an OR operation on the first binary signal from the first discrimination circuit and the second binary signal from the second discrimination circuit and outputs the single rectangular-wave signal.

14. The optical signal transmission system according to claim 11, wherein

the rectangular-wave forming means of the optical signal receiver has:

a first limiter amplifier that limits and amplifies the first electrical signal from the photoelectric conversion circuit and outputs a first binary signal;

a second limiter amplifier that limits and amplifies the second electrical signal from the photoelectric conversion circuit and outputs a second binary signal;

an adder circuit that adds the first binary signal from the first limiter amplifier and the second binary signal from the second limiter amplifier and outputs a ternary signal; and

a high level discriminator that discriminates the level of the ternary signal from the adder circuit by comparing its magnitude with a threshold existing between a level when the optical signal is inputted into both the first photoelectric conversion circuit and the second photoelectric conversion circuit and a level when the optical signal is inputted into either the first photoelectric conversion circuit or the second photoelectric conversion circuit and outputs the single rectangular signal.

~~15. The optical signal transmission system according to~~ claim 11, wherein

the rectangular-wave forming means of the optical signal receiver has:

a first limiter amplifier that limits and amplifies the first electrical signal from the first photoelectric conversion circuit and outputs a first binary signal;

a second limiter amplifier that limits and amplifies the second electrical signal from the second photoelectric

conversion circuit and outputs a second binary signal;

an adder circuit that adds the binary signal from the first limiter amplifier and the binary signal from the limiter amplifier and outputs a ternary value signal; and

a low level discriminator that discriminates the level of the ternary signal from the adder circuit by comparing its magnitude with a threshold existing between a level when the optical signal is inputted into either the first photoelectric conversion circuit or the second photoelectric conversion circuit and a level when the optical signal is inputted into neither the first photoelectric conversion circuit nor the second photoelectric conversion circuit and outputs the single rectangular signal.

16. The optical signal transmission system according to any of claims 11 through 15, wherein

the optical signal transmitter further comprises a predistortion circuit that adds beforehand a distortion inverse to a distortion that the FM batch conversion circuit generates.